

Sources of Exposure

Toxicokinetics and Biomonitoring

Biomarkers/Environmental Levels

General Populations

- The general population may be exposed to MTBE through inhalation of ambient air or ingestion of contaminated water.
- Dermal exposure and inhalation may also occur during bathing or washing activities if the water contains MTBE.
- Populations living near contaminated hazardous waste sites may have increased exposure via ambient air, groundwater contamination, and/or vapor intrusion, compared to the general population.

Occupational Populations

- MTBE is no longer used as a gasoline additive in the United States.
- MTBE was still manufactured within the United States as recently as 2020 (primarily for export to other countries).
- According to the U.S. Toxic Release Inventory (TRI), there have been no reported production volume since December 2020 and the U.S. Energy Information Administration has not shown updated export information on MTBE since 2019. However, since only certain types of facilities were required to report to TRI, it is uncertain if MTBE is still being produced in the United States for export to other nations.
- If MTBE is currently being produced in small quantities in the United States (for export) in facilities not required to report production volume to TRI, occupational exposure is possible.

Toxicokinetics

- MTBE is readily absorbed following inhalation or oral exposure, and to a lesser extent following dermal exposure.
- Absorbed MTBE is initially widely distributed; the liver contains a large percentage of the initial body burden; smaller amounts are found in lungs, kidney, and testes.
- Most absorbed MTBE is rapidly metabolized; hepatic first-pass metabolism of MTBE is likely following oral exposure.
- MTBE metabolites are rapidly excreted, predominantly in the urine.

NHANES Biomonitoring

- In the 2015–2016 National Health and Nutrition Examination Survey (NHANES), geometric mean and 95th percentile concentrations were below the limit of detection.

Biomarkers

- MTBE and its metabolite, *tert*-butanol, can be measured in expired air and blood after recent exposure.
- The primary urinary metabolite, 2-hydroxyisobutyric acid, can also serve as a biomarker for recent exposure. However, MTBE metabolites are not unique to MTBE.

Environmental Levels

Air

- Levels of MTBE measured at 8,401 locations across the United States (2021) were ≤ 0.34 ppbv.

Water

- In a nationwide survey of groundwater and surface water samples in 2016, MTBE was detected in 7% of the samples, with concentrations ranging from 0.016 to 0.226 $\mu\text{g/L}$.

Sediment and Soil

- There are no recent monitoring data for levels of MTBE in sediment or soil.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2023. Toxicological Profile for Methyl *tert*-Butyl Ether. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™ for Methyl *tert*- Butyl Ether (MTBE)



CAS #1634-04-4

September 2023

U.S. Department of Health and
Human Services
Public Health Service
Agency for Toxic Substances
and Disease Registry
www.atsdr.cdc.gov



Chemical and Physical Information

Routes of Exposure

Relevance to Public Health (Health Effects)

Methyl *tert*-Butyl Ether (MTBE) is a Liquid

- MTBE is a volatile organic compound (VOC). It is a colorless liquid with a terpene-like odor.
- MTBE is flammable and moderately soluble in water.
- MTBE is very soluble in some organic solvents such as alcohol and ether.
- In the mid-to-late 1980s, MTBE was added to gasoline as an effort to reduce air pollution. Its use in gasoline peaked in the 1990s, but due to increased levels in the environment (e.g., groundwater) and concerns regarding toxicity, MTBE use declined in the early 2000s. Its use in gasoline ceased once the requirement to use oxygenated blending agents, such as MTBE, as gasoline additives in the United States stopped in 2005.
- MTBE is still used as an oxygenate in many other countries.
- MTBE was previously used in the United States as a pharmaceutical to dissolve gallstones in patients for which surgery was not an option. MTBE has not been approved for medical use in the United States since 2015, but is still used as a non-surgical option in other countries.

- Inhalation – Likely route of current exposure for general population and historical exposure for occupational population.
- Oral – Likely route of exposure for the general population through ingestion of contaminated water.
- Dermal – Possible route of exposure for general population through bathing or washing in water containing MTBE. Historical exposure route for occupational population.

MTBE in the Environment

- In the air, MTBE is expected to exist entirely in the vapor phase. It can be transported to the earth by wet and dry deposition.
- The atmospheric half-life is estimated to be 2.4 days.
- MTBE tends to volatilize rapidly from surface water and surface soils.
- Due to its high mobility in soil, any MTBE that is not volatilized is likely to leach into lower soil horizons and contaminate groundwater.
- MTBE is slow to degrade in water.
- MTBE is unlikely to bioconcentrate in aquatic or terrestrial organisms.

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

Inhalation

- An acute-duration (≤ 14 days) inhalation MRL of 2 ppm was derived for MTBE.
- An intermediate-duration (15–364 days) MRL of 1 ppm was derived for MTBE.
- A chronic-duration (≥ 365 days) inhalation MRL of 1 ppm was derived for MTBE.

Oral

- No acute- or chronic-duration oral MRLs were derived for MTBE.
- An intermediate-duration (15–364 days) oral MRL of 0.4 mg/kg/day was derived for MTBE.

Health Effects

- The predominant and immediate effects of inhaling high levels of MTBE in people and animals are transient central nervous system (CNS) depression, nausea, vomiting, dizziness, hypoactivity, ataxia, and anesthesia. CNS depression also occurs following high oral exposure in animals.

Health Effects

- Patients treated with intracystic MTBE for gallstone dissolution reported gastrointestinal side effects (vomiting, nausea, anorexia) and hepatic side effects.
- Oral and inhalation exposure of MTBE in animals leads to respiratory and gastrointestinal tract irritation and/or inflammation, hepatic toxicity, and lymphoreticular lesions. The developing and mature male reproductive system is also an oral toxicity target.
- Developmental toxicity (litter resorption, post-implantation loss, delayed ossification, cleft palate) was only observed after inhalation exposure to high concentrations of MTBE at levels that also resulted in overt parental toxicity.
- Chronic-duration inhalation exposure of MTBE in animals resulted in an increase in hepatic tumors, while oral exposure led to testicular tumors, lymphoma, and leukemia.
- The International Agency for Research on Cancer (IARC) has determined that MTBE is not classifiable as to its carcinogenicity in humans. The Environmental Protection Agency (EPA) and The Department of Health and Human Services (HHS) have not classified the potential for MTBE to cause cancer in humans.

Children's Health

- It is not known if children are more sensitive to MTBE exposure than adults.